WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005MT58B

Title: STUDENT FELLOWSHIP: Mountain front GW recharge: groundwater/surface-water exchange across an alpine-valley transition

Project Type: Research

Focus Categories: Geomorphological Processes, Groundwater

Keywords: groundwater transport

Start Date: 03/15/2005

End Date: 06/30/2006

Federal Funds: $3,000

Non-Federal Matching Funds: $0

Congressional District: At Large

Principal Investigators:
Brian Leonard McGlynn
Montana State University

Timothy Covino

Abstract

Critical Water Problem

Understanding mountain front groundwater (GW) recharge and how GW/surface-water (SW) exchange impacts the timing, magnitude, and chemistry of GW and SW resources is critical to managing water resources in Montana. Although the importance of this research need is widely accepted, little improvement has been made in terms of understanding these hydrologic processes. It is becoming increasingly evident that mountain front recharge is an important source of water contributing to inter-mountain basin-fill aquifers in the western U.S. (Manning and Solomon, 2003). Furthermore, current research suggests that mountain front recharge accounts for one third to nearly all of the GW recharge occurring in these settings (Anderson and Freethey, 1996; Prudic and Herman, 1996; Gates, 1995; and Mason, 1998). Many streams in alpine to valley watersheds are sustained during baseflow from GW inputs. Water usage in the valley bottom is dependent on this source water contribution to channel flow for in stream flow

levels, irrigation withdrawals, and inputs to storage reservoirs, lakes, and ponds. Because of this dependence on GW resources to sustain baseflow and for GW and SW withdrawals, it is necessary to protect GW resources throughout the state. Effective management strategies to ensure adequate GW storage and GW quality will benefit from the proposed research to investigate mountain front GW recharge, which is a common hydrologic process in Montana and the inter-mountain west.

The exchange of water between GW and SW resources in alpine-valley transition zones and across the valley bottom can have a profound effect on the amount and chemistry of water entering and exiting the channel. This exchange can serve to buffer hydrologic response and chemistry of water available for use in meso-scale watersheds. In many valleys, streams change in both space and time from gaining water from GW to losing water to GW as they flow toward the valley bottom. In times of high runoff (e.g. spring), runoff from alpine areas can be a significant source of GW recharge in the transition zone. During periods of low runoff (e.g. summer), transition zones can be a source of streamflow from stored GW. In addition, throughout the year, significant exchange between the stream and local GW can reset or modify SW chemistry and isotopic signatures. I hypothesize that valley transitions function as hydrologic and biogeochemical buffers, groundwater recharge and discharge zones, and reflections of integrated local and alpine hydrologic and climatic processes. Transition zones between alpine headwater watersheds and the valley bottom are a common landscape feature in the state of Montana and, as I have hypothesized, are an important zone where GW/SW exchange occurs. Because transition zones are a common landscape feature of watersheds in Montana, and because the GW/SW exchange that occurs in these zones is important in controlling stream discharge magnitude and chemistry, understanding these hydrologic processes is an important research need in the state of Montana.